(12) PATENT **(11)** Application No. **AU 199965367 B2**
(19) AUSTRALIAN PATENT OFFICE **(10)** Patent No. **731982**

(54) Title
Improved bulkhead fitting for underground sump

(51)[7] International Patent Classification(s)
F16L 005/10

(21) Application No: **199965367** (22) Application Date: **1999.12.21**

(43) Publication Date : **2000.03.23**
(43) Publication Journal Date : **2000.03.23**
(44) Accepted Journal Date : **2001.04.12**

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(56) Related Art
WO 90/07074
DE 4014684
US 5295760

ABSTRACT

An entry fitting have a cylindrical portion (36) and a conical portion (40) including a seal disposed about the body of the entry fitting. An axial displacement member (46) urges the seal along the conical portion to achieve a relatively wide range of sealing force. The entry fitting can include a shield (60) positioned on the exterior of a sump to provide an access space for displacement of the entry fitting toward the exterior of the sump to allow removal and replacement of the seal without first having to remove backfill from the exterior of the sump.

AUSTRALIA

Patents Act 1990

COMPLETE SPECIFICATION

STANDARD PATENT

APPLICANT: DOVER CORPORATION
NUMBER:
FILING DATE:

Invention Title: IMPROVED BULKHEAD FITTING FOR UNDERGROUND SUMP

The following statement is a full description of this invention, including the best method of performing it known to me:

IMPROVED BULKHEAD FITTING FOR UNDERGROUND SUMP

TECHNICAL FIELD

This invention relates generally to the field of bulkhead or entry fittings used in underground sumps, and more particularly to an entry fitting which achieves an increased range of adjustable sealing force.

BACKGROUND OF THE INVENTION

Entry fittings are used in underground sumps to seal the interface between an access opening of the sump and a pipe extending into the sump through the access opening. Entry fittings are designed to prevent the flow of a fluid, such as gasoline, which has leaked into the sump, from entering the surrounding ground, and for preventing the flow of ground water into the sump.

An underground sump can require one or more such entry fittings depending upon the number of fuel conduits entering and exiting the sump. Access openings are usually formed in the sump at the installation site. Due to varying conditions in the field, and of the sump itself, an access opening can sometimes be out-of-round, or have an irregular shape. Conventional entry fittings, however, have a relatively fixed or small range of sealing force, and will only properly seal when used with an access opening that has a regular shape, and also a certain diameter. Thus, if an irregular access opening is formed in a sump, or the diameter is slightly larger than specified for the particular entry fitting

size, either a larger hole must be formed and a larger entry fitting utilized, or the sump must be discarded.

After an entry fitting has been initially installed, the seal eventually ages and takes a compression set. Slight movement of the pipe or thermal expansion and contraction can result in leakage about the seal. When this occurs, conventional entry fittings must be entirely replaced due to the lack of or the relatively small range of adjustable sealing force provided by such entry fittings.

There are several conventional entry fitting designs in use. One such entry fitting includes a rubber boot have a planar portion and a tubular portion, the tubular portion being conjoint with and perpendicular to the planar portion. The planar portion is positioned on the exterior of the sump wall and contains bolts which extend through a plurality of holes drilled in the sump and through a compression ring positioned on the interior of the sump wall. Nuts threadedly engage the bolts and pull the planar portion against the exterior of the sump wall. The tubular portion extends into the sump through the access opening, and is sealingly clamped to the pipe. This type of entry fitting does not allow a range of adjustable sealing force between the planar portion and the sump wall, and requires considerable installation time due to the required drilling of holes, and tightening of the requisite nuts and bolts. Further, if the boot develops a leak, the entire entry fitting must be replaced, since there is not a separate seal separable from the entry fitting. Further, replacement of the entry fitting may necessitate removal of backfill from the exterior of the sump to permit withdrawal and replacement of the boot.

Another conventional entry fitting currently in use includes a boot which is positioned in the access opening, and a rigid plastic insert which is forced into the boot

to be concentric with the access opening and radially urge the boot against the edge of the access opening. However, the rigid plastic insert has a predetermined size, and thus the boot and insert require a fairly specific size opening. Further, if the boot develops a leak, the entire boot must be replaced as there is no mechanism for increasing the radial force exerted by the plastic insert.

It is apparent that an entry fitting which achieves an increased range of adjustable sealing force and allows flexibility in the size and shape of access openings in which it can be used, which allows replacement of a relatively inexpensive seal without replacement of the entire entry fitting, and which can be replaced without requiring removal of backfill from the exterior of the sump would be desirable.

SUMMARY OF THE INVENTION

Objects of this invention are achieved with an entry fitting having a body with an exterior surface in which a first portion of the surface has a first radius, a second portion of the surface has a second radius, and the second radius is greater than the first radius. A transition portion of the exterior surface of the entry fitting is positioned between the first portion and the second portion, and the transition portion has a greater radius than the first portion and a smaller radius than the second portion. A seal is circumferentially positioned about the body, and provides a sealing interface between the body and a sump access opening. An axial displacement member such as a nut is positioned about the body and urges the seal axially along the exterior surface of the body. As the seal is axially moved against the transition portion, the seal is radially urged outward against the edge of the access opening. The exterior surface of the body which forms the transition portion has an increasing radius in a direction toward the second portion. Thus the transition portion can be adjusted with respect to the access opening to provide a seal for a relatively large range of access opening diameters. Further, the transition portion can be axially adjusted with respect to the access opening to provide an adjustable range of sealing force.

According to one embodiment of this invention, a seal is positioned about the entry fitting body and contains an annular groove which closely receives an edge of the sump wall forming the access opening. A first circumferential portion of the interior

surface of the washer conforms to the contour of the transition portion, while a second circumferential portion of the interior surface of the washer conforms to the first portion of the surface.

According to another embodiment of this invention, a shield having a first end and a second end is provided which is positioned on the exterior of the sump wall. The shield defines an internal access space intermediate the first and second ends. The access space is disposed about an axial portion of the pipe and has a diametral dimension larger than the corresponding diametral dimension of the entry fitting. The access space has an axial dimension sufficient to allow displacement of a portion of the entry fitting into the access space. The first end of the shield circumscribes the access opening and is in proximity to the wall so as to inhibit the flow of backfill material into the access space between the shield and the wall. The second end of the shield circumscribes the pipe so as to inhibit the flow of backfill into the access space between the shield and the pipe. The shield is removably fixed with respect to the pipe so as to selectively prevent relative axial displacement between the pipe and the shield and to secure the position of the shield relative to the wall.

Still other objects of the present invention will become apparent to those skilled in this art from the following description wherein there is shown and described a preferred embodiment of this invention, simply by way of illustration, of one of the best modes contemplated for carrying out the invention. As will be realized, the invention is capable of different obvious aspects all without departing from the invention. Accordingly, the drawings and description will be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings incorporated in and forming a part of the specification, illustrate several aspects of the present invention, and together with the description serve to explain the principals of the invention. In the drawings:

Fig. 1 is a schematic cross-sectional view of a fuel dispensing system showing an entry fitting according to one embodiment of this invention;

Fig. 2 is a cross-sectional view of an entry fitting and shield according to another embodiment of this invention;

Fig. 3 is a side view of an entry fitting according to another embodiment of the invention; and

Fig. 4 is a cross-sectional view taken along line 4-4 of Fig. 3.

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings, wherein like numerals indicate the same elements throughout the views.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, Fig. 1 shows a schematic view of a fuel dispensing system. Fuel dispensers 20 and 22 are in communication with fuel conduit 24 which in turn is in communication with underground fuel tank 26. Upon demand, fuel flows from underground fuel tank 26 through fuel conduit 24 to fuel dispensers 20 and 22. A sump, such as sumps 28 and 30, surround each location where it is necessary to provide fuel conduit 24 with a fitting. Sump 28 captures fuel which can leak from fitting 29 or fuel dispenser 20 and prevents such fuel from entering backfill 68.

An entry fitting 32 is positioned at each access opening in the wall of sump 28. Entry fitting 32 provides a seal between conduit 24 and sump 28. Shield 60 is positioned on the exterior of sump 28 and prevents backfill 68 from surrounding the exterior of sump 28 in the area of entry fitting 32. The access space provided by shield 60 enables axial movement of entry fitting 32 outside of sump 28, as described in more detail below, and replacement of a seal associated with entry fitting 32 without removal of backfill 68. A similar entry fitting 32 is provided in sump 30 and access 31 to seal respective access openings.

Fig. 2 shows entry fitting 32 according to one embodiment of this invention. Body 34 includes surface 35 having a first portion 36, second portion 40, and transition portion 38. First portion 36 has first radius 37 which is less than second radius 41 of second portion 40. Transition portion 38 extends between first portion 36 and second portion 40 and includes a transition radius 39 which is greater than first radius 37 and less than second radius 41. According to the embodiment of entry fitting 32 shown in Fig. 2, first portion 36 generally defines a cylindrical exterior surface, and transition portion 38 and second portion 40 generally define a conical portion which is conjoint with first portion 36.

Seal 44 is positioned circumferentially about body 34 and provides a sealing interface between body 34 and wall 45. Seal 44 prevents fluid from exiting sump 28 and entering backfill 68. Seal 44 can comprise an elastomer or any other composition known in the art suitable for its purposes. Body 34 is rigid, and can comprise a metal or thermoplastic, in a preferred embodiment body 34 comprises a thermoset material. Entry fitting 32 also includes an axial displacement member such as nut 46 which can be

threadedly engaged with an exterior threaded portion of body 34. Nut 46 can comprise the same materials as body 34. Nut 46 advances along surface 35 toward second portion 40 as it is rotated. Advancement of nut 46 urges seal 44 against transition portion 38 which in turn urges seal 44 radially outward and against wall 45. As shown in Fig. 2, if the access opening formed by wall 45 were larger than that shown in Fig. 2, entry fitting 32 need only be slightly displaced toward the interior of sump 28 to sufficiently seal the opening in conjunction with seal 44. Thus, the entry fitting according to this invention allows a single entry fitting to seal a relatively wide range of access opening diameters. As nut 46 is advanced along surface 35, seal 44 is increasingly urged radially outward by transition portion 38, achieving a wide range of sealing force. Thus, should seal 44 begin to leak after installation, nut 46 need only be further axially advanced along surface 35 to reseal the access opening, potentially eliminating a need to replace seal 44.

The wide range of adjustable sealing force achieved by entry fitting 32 according to this invention enables the use of a single size entry fitting with a relatively wide range of access opening diameters. Entry fitting 32 can also accommodate irregularly shaped access openings. Installation is relatively fast because a single nut is used to adjust the sealing force between fuel conduit 24 and wall 45.

Washer 48 can be positioned between seal 44 and nut 46 to reduce friction. Washer 48 can comprise a high density polyethylene or any other relatively low friction material.

Seal 44 can include a first interior surface such as first portion 47 which conforms to the contour of first portion 36 of surface 35. Seal 44 can also include a second interior surface such as second portion 49 which conforms to the contour of transition portion 38

of surface 35. Seal 44 preferably, but not necessarily, includes annular groove 43 for closely receiving an edge of wall 45 and surrounding the edge of wall 45 for increasing the seal contact area between seal 44 and wall 45.

Clamp 50 sealingly urges one end of boot 52 against the periphery of end 53 of body 34, and boot 54 sealingly urges the other end of boot 52 against fuel conduit 24 to prevent fuel from entering the space between fuel conduit 24 and the interior surface of body 34.

Figs. 3 and 4 show entry fitting 32 according to another embodiment of this invention. As shown in Fig. 4, the diameter of the exterior surface of body 134 in the area which supports nut 146 has a larger diameter with respect to end 53 of body 134 than the entry fitting shown in Fig. 3. Correspondingly, the interior diameter of seal 144, washer 148 and nut 146, each of which is circumferentially positioned about body 134, have been increased. Such increased interior diameter allows removal of nut 146 from body 134 without requiring removal of clamp 50, boot 52 or clamp 54. This facilitates quick removal and replacement of seal 144 without needing to disturb the existing seal between clamp 50 and end 53.

Entry fitting 32 is installed in sump 28 by inserting transition portion 38 and seal 44 in the access opening formed by wall 45 and advancing nut 46 along surface 35 until sufficient sealing force between surface 35 and wall 45 is achieved. If, over time, seal 44 develops a leak, nut 46 need only be additionally rotated and advanced toward second portion 40 to increase the sealing force and reseal the access opening. If seal 44 has completely failed and requires replacement, fuel conduit 24 is disconnected from its fitting in sump 28, nut 46 is rotated in a reverse direction toward the interior of sump 28

to relieve pressure on seal 44, and is slid along with washer 48 over clamp 50, boot 52 and down the length of fuel conduit 24 and removed. Body 34 can be urged toward the exterior of sump 28 in a direction toward backfill 68 to relieve the radial force on seal 44. After body 34 is extended sufficiently into access space 62, seal 44 can similarly be slid over clamp 50, boot 52 and down the length of fuel conduit 24 and removed.

A new seal 44 is then placed over fuel conduit 24 and slid back onto body 34, followed by washer 48 and nut 46. Thus, even a complete failure of seal 44 can be fixed by replacement of a relatively inexpensive seal, rather than a new entry fitting 32. Further, replacement of seal 44 is a relatively quick process.

Fig. 2 shows shield 60 according to another embodiment of this invention. Shield 60 includes first end 64 and second end 66 spaced from first end 64. Shield 60 defines access space 62 which is intermediate first end 64 and second end 66, and which is disposed about an axial length of fuel conduit 24. Access space 62 has a diametral dimension larger than the corresponding diametral dimension of end 55 of body 34. Access space 62 also has an axial dimension sufficient to allow displacement of end 55 axially into access space 62 of shield 60. Shield 60 can comprise any suitable rigid material.

First end 64 circumscribes the access opening formed by wall 45 and is in sufficient proximity to wall 45 to prevent backfill 68 from entering access space 62. The distance between end 64 and wall 45 can vary depending upon the diameter of backfill 68. It is preferred that the distance between end 64 and wall 45 be less than the diameter of backfill 68 to prevent backfill 68 from entering access space 62.

Second end 66 circumscribes fuel conduit 24 to inhibit backfill 68 from entering access space 62 between fuel conduit 24 and shield 60. Shield 60 is removably fixed with respect to fuel conduit 24 to selectively prevent relative axial displacement between fuel conduit 24 and shield 60, and to secure the position of first end 64 with respect to wall 45. Clamp 70 radially urges first end 66 against fuel conduit 24 to prevent relative axial displacement between shield 60 and fuel conduit 24.

Access space 62 should have a sufficient axial dimension to allow sufficient displacement of end 55 of body 34 into access space 62 to allow removal of seal 44 from body 34.

The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment was chosen and described in order to best illustrate the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto.

CLAIMS

1. In combination with an at least partially underground container having a wall with an access opening, and an entry fitting disposed within the access opening for sealing the access opening and receiving a pipe passing through the wall, a structure for providing an access space external to the wall about a portion of the pipe and an end of the entry fitting, including:

a shield, the shield having a first end and a second end spaced from the first end, the shield defining an internal access space intermediate the first and second ends, the access space being disposed about an axial portion of the pipe and having a diametral dimension larger than the corresponding diametral dimension of the entry fitting and an axial dimension sufficient to allow displacement of a portion of the entry fitting into the access space;

the first end of the shield circumscribing the access opening and being in proximity to the wall so as to inhibit the flow of backfill material between the shield and the wall and into the access space, the second end of the shield circumscribing the pipe so as to inhibit the flow of backfill between the shield and the pipe and into the access space;

the shield being removably fixed with respect to the pipe so as to selectively prevent relative axial displacement between the pipe and the shield and to secure the position of the shield relative to the wall.

2. The structure according to Claim 1, further including a clamp circumferentially positioned about the second end of the shield for removably fixing the shield with respect to the pipe.

3. The structure according to Claim 1 or Claim 2, wherein the interior surface of the shield defining the access space has a plurality of steps extending from the first opening to the second opening, the cross-sectional area of the space defined by each successive step decreasing in a direction toward the second opening.

4. In combination with an at least partially underground container having a wall with an access opening, and an entry fitting disposed within the access opening for sealing the access opening and receiving a pipe passing through the wall, a structure for protecting the entry fitting comprising a shield, the shield having a first end disposed about the entry fitting in proximity to the wall and a second end of the shield being disposed about the pipe in spaced relationship to the first end, and the shield being operative to at least partially shield the entry fitting from backfill surrounding the underground container.

5. The structure according to claim 1, wherein the first end of the shield is spaced from the entry fitting.

6. The structure according to claim 1, wherein the shield is positioned completely external to the wall.

7. The structure according to claim 4, wherein the first end of the shield is spaced from the entry fitting.

8. The structure according to claim 4, wherein the shield is positioned completely external to the wall.

9. The structure according to claim 4, wherein the shield is removably fixed with respect to the pipe.

10. The structure according to claim 9, further comprising a clamp circumferentially positioned about the second end of the shield for removably fixing the shield with respect to the pipe.

11. The structure according to claim 4, wherein the shield defines an access space intermediate the first and second ends, the access space being disposed about an axial portion of the pipe, and having a diametral dimension larger than the corresponding diametral dimension of the entry fitting and an axial dimension sufficient to allow displacement of a portion of the entry fitting into the access space.

12. The structure according to claim 11, wherein an interior surface of the shield defines the access space, and wherein the interior surface has a plurality of steps extending from the first end to the second end, the cross-sectional area of the access space defined by each successive step decreasing in a direction toward the second end.

13. The structure according to claim 4, wherein the first end of the shield circumscribes the access opening so as to inhibit the backfill from flowing between the shield and the wall, and wherein the second end of the shield circumscribes the pipe so as to inhibit the backfill from flowing between the shield and the pipe.

14. A piping system comprising:

(a) an at least partially underground container capable of being surrounded by backfill having a wall with an access opening;

(b) a pipe passing through the access opening;

(c) an entry fitting disposed within the access opening for sealing the access opening and receiving the pipe; and

(d) a structure configured to provide an access space external to the wall about a portion of the pipe and an end of the entry fitting, the structure comprising a shield having a first end and a second end spaced from the first end, the shield defining the access space intermediate the first and second ends, the access space being disposed about an axial portion of the pipe and having a diametral dimension larger than a corresponding diametral dimension of the entry fitting and an axial dimension sufficient to allow displacement of a portion of the entry fitting into the access space, wherein the first end of the shield circumscribes the access opening so as to inhibit backfill from falling between the shield and the wall, and wherein the second end of the shield circumscribes the pipe so as to inhibit backfill from flowing between the shield and the pipe.

15. The structure according to claim 14, wherein the first end of the shield is spaced from the entry fitting.

16. The structure according to claim 14, wherein the shield is positioned completely external to the wall.

17. The structure according to claim 14, wherein the shield is removably fixed with respect to the pipe.

18. The structure according to claim 17, further comprising a clamp circumferentially positioned about the second end of the shield for removably fixing the shield with respect to the pipe.

19. A structure for providing an access space substantially as herein described.

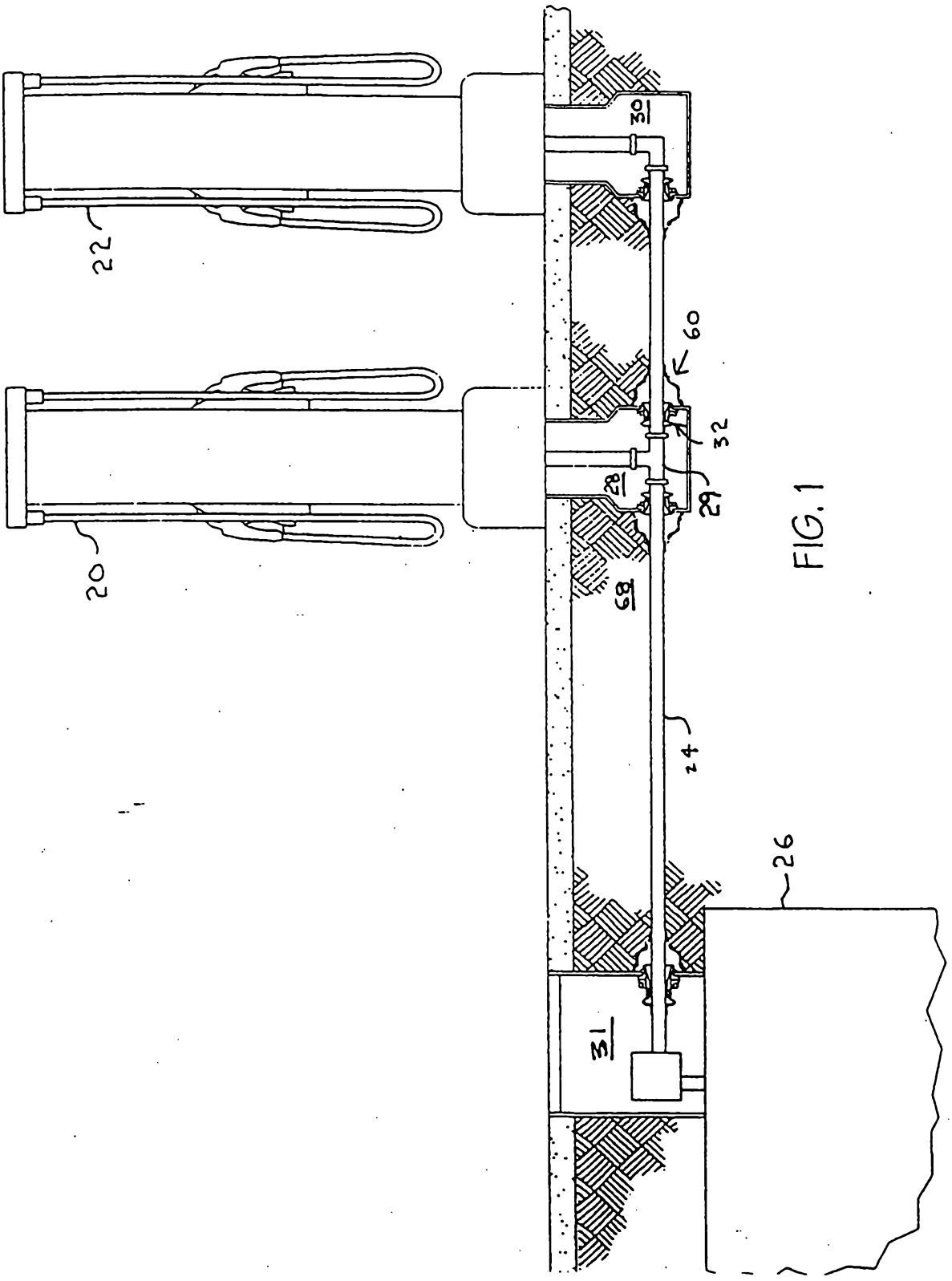

FIG. 1

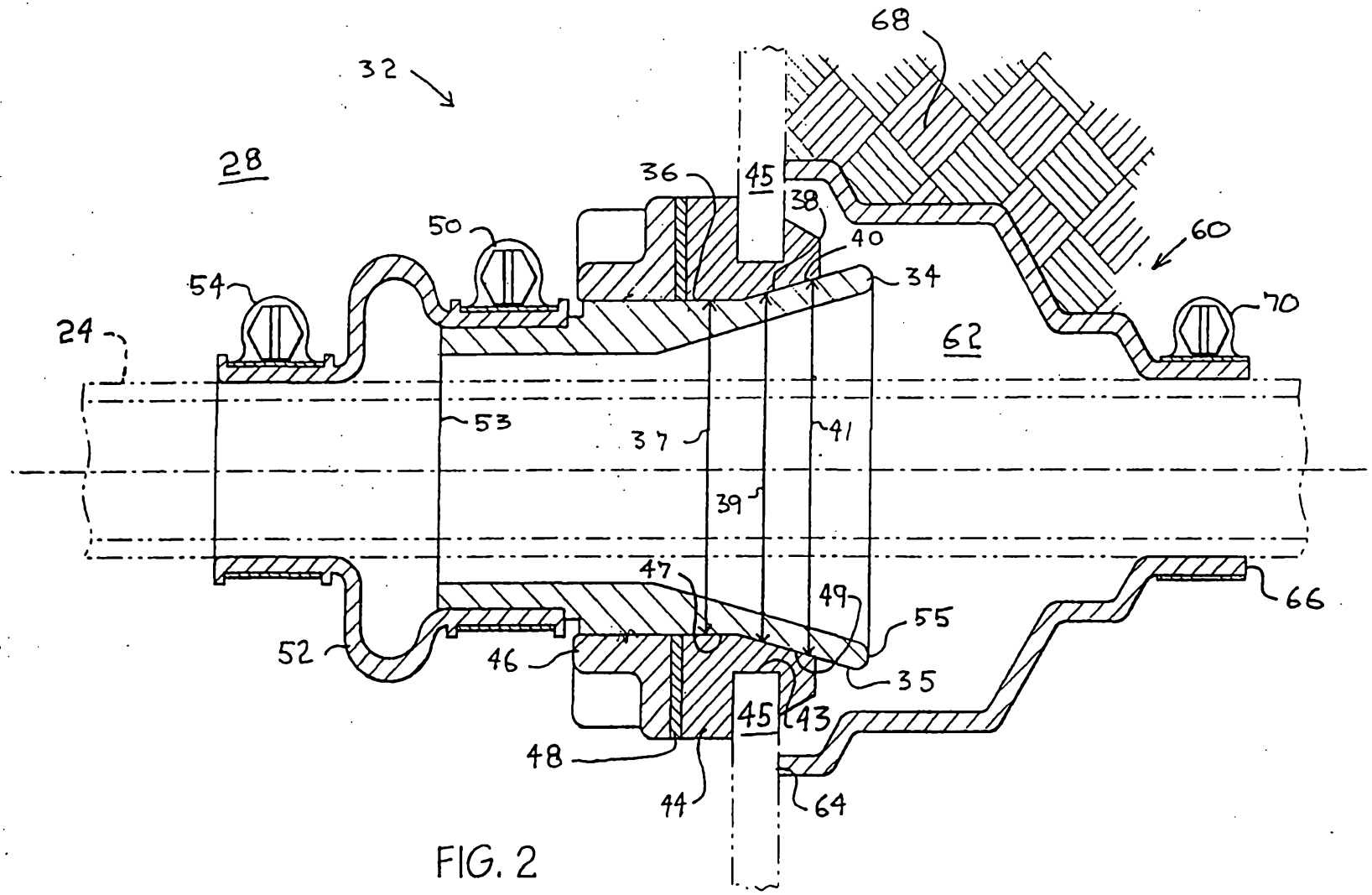
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FIG. 2

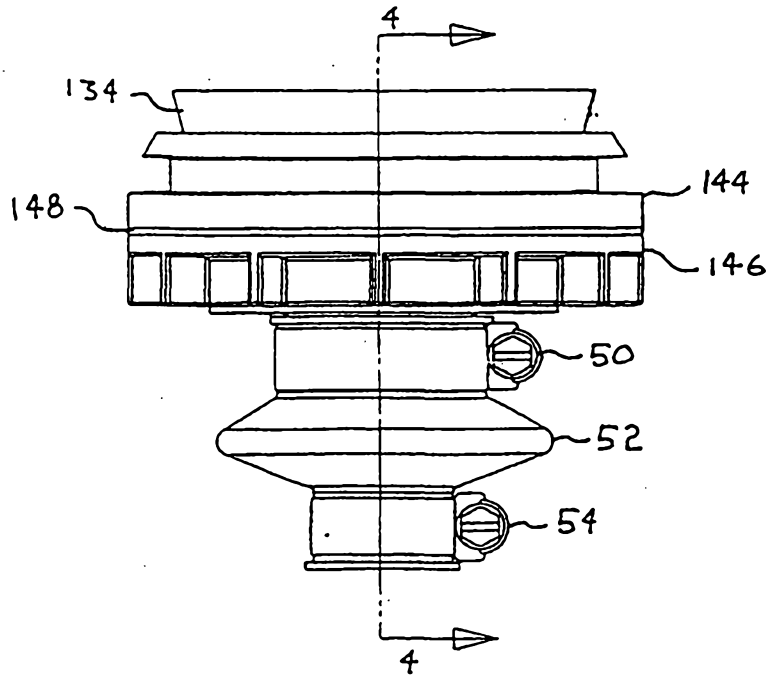

FIG. 3

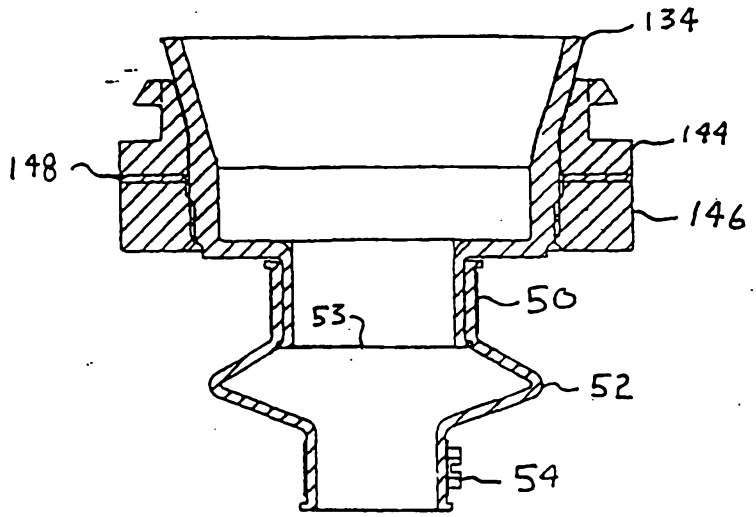

FIG. 4